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# AXIS AIRFORCE REQUIREMENTS OF PETROLEUM, 1942

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SUBMITTED TO THE "ENEMY OIL COMMITTEE"

BY THE SUB-COMMITTEE ON MILITARY CONSUMPTION OF PETROLEUM

PREPARED IN THE RESEARCH AND ANALYSIS BRANCH

OF THE OFFICE OF STRATEGIC SERVICES

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# AXIS AIRFORCE REQUIREMENTS OF PETROLEUM, 1942

## I. SUMMARY

### 1. Total Axis Airforce Requirements of Petroleum.

In 1942 the airforces of Germany, Italy, and the other Axis satellite countries consumed an estimated 1,143,000 tons of aviation gasoline and 57,000 tons of aviation lubricants for operational flying, air transportation, ferrying, and training. Ground services and AA establishments needed an additional 600,000 tons of motor fuel (light motor fuel and Diesel oil) and 30,000 tons of lubricants. Total Axis airforce petroleum requirements were therefore 1,830,000 tons.

TABLE I

AXIS AIRFORCE REQUIREMENTS OF PETROLEUM BY PRODUCTS, 1942

(thousand metric tons)

| | Aviation Gasoline | Motor Fuel[1] | Lubricants[2] | Total[3] |
|---|---|---|---|---|
| German Airforce | 812.2 | 480.0 | 69.6 | 1,461.8 |
| Italian Airforce | 105.0 | 60.0 | 8.2 | 173.2 |
| Axis Satellites | 126.4 | 60.0 | 9.4 | 195.8 |
| TOTAL | 1,143.6 | 600.0 | 87.2 | 1,830.8 |

1/ An estimated 75 per cent or 480,000 tons consist in light motor fuel and 25 per cent or 150,000 tons in Diesel oil.
2/ Five per cent of aviation gasoline and motor fuel requirements.
3/ Includes an allowance of 20 per cent for wastage and losses.

2. Comparison with British Estimates. U.S. estimates of Axis airforce requirements of aviation gasoline, motor fuel, and lubricants in 1942 correspond closely to the British estimates. The latter put the total petroleum consumption of Axis airforces in 1942 at 1,840,000 tons of which 1,125,000 tons were aviation gasoline and 715,000 tons motor fuel and lubricants.

3. Geographical Breakdown of Consumption. An exact breakdown of airforce requirements by countries is not possible. Sortie statistics for operational flying are given only for broad geographical areas. No such breakdown is available for air transportation and training. It was, therefore, assumed that the petroleum demand for air transportation originates in those areas where the transport planes are stationed. Training is assumed to take place at home bases, except in the case of Reserve Training Units. The petroleum consumption of Reserve Training Units was allocated to the three main areas of operation in proportion to their aviation gasoline requirements.

TABLE II

AXIS AIRFORCE REQUIREMENTS OF PETROLEUM BY GEOGRAPHIC AREAS, 1942

(thousand metric tons)

| | Aviation Gasoline | Motor Fuel | Lubricants | Total |
|---|---|---|---|---|
| Western and Central Europe | 303.5 | 160.0 | 23.3 | 486.8 |
| Eastern Europe | 572.0 | 300.0 | 43.5 | 915.5 |
| Mediterranean | 268.1 | 140.0 | 20.4 | 428.5 |
| TOTAL | 1,143.6 | 600.0 | 87.2 | 1,830.8 |

4. Methods of Estimation for the GAF and IAF. The estimates for the aviation gasoline consumption of the German and Italian airforces are based on the number of airplane sorties during 1942, as provided by the Military Supplies Section of the Research and Analysis Branch of the Office of Strategic Services. Sortie figures were broken down by type of plane, i.e. long range bombers, dive bombers, single-engine fighters, twin-engine fighters, army cooperation planes, coastal planes and transport planes. The tankage capacity of the various Axis models belonging to each of these types was established. An average tankage capacity per type was then calculated by weighting the tankage of the different models according to their relative contribution to enemy first line strength. Aviation gasoline consumption for each sortie per plane of each type was assumed to be three-fourths of the average tankage

capacity of this type as established above.

To allow for models which are occasionally provided with excess tankage capacity (belly tanks, for instance), it was assumed that the gasoline consumption of three-fourths of the total number of sorties amounted to three-fourths of the normal tankage capacity. The requirements of the remaining quarter of the sorties was estimated at three-fourths of the maximum tankage capacity. In the case of long range reconnaissance bombers, however, it was assumed that three-fourths of the normal tankage was used in one-fourth of the number of sorties, and three-fourths of the maximum tankage in the rest.

The consumption estimates for the ferrying services were based on an estimate of the number and length of flights necessary to maintain the required strength in the various theatres of operation.

The estimate of requirements for training purposes was based on the number of planes available for training and upon information concerning the Axis pilot training program.

In the case of Italy, as there was no other information available, the rate of sorties per transport and per training plane was estimated to be only 50 per cent of the corresponding rate for German planes. This percentage reflects the difference in the relative activity of German and Italian operational planes.

5. Method of Estimation for the Airforces of Axis Satellites.

The number of sorties per plane for most of the Axis satellite countries during 1942 (Hungary, Rumania, Bulgaria, and Finland) was also estimated at 50 per cent of the corresponding German rate of activity. For ~~the~~ reconnaissance and army cooperation planes a higher rate was chosen to allow for the operational flights of the large number of Axis satellite troops on the Eastern Front. The number of sorties per plane for the Vichy French and Croatian airfleets was put at 25 per cent of the German rate.

The petroleum consumption per plane per sortie for all satellite countries was estimated at about 70 per cent of the corresponding German rate. Petroleum requirements for training and transport planes of the Axis satellites were computed at 20 per cent and 15 per cent of their operational requirements respectively. This rate is considerably below that applicable to Germany and Italy.

6. Petroleum Requirements of Ground and Supply Services. The motor fuel (light motor fuel and Diesel oil) requirements for servicing and supply units and for anti-aircraft establishments were calculated on the basis of preliminary data on the number of motor driven units available to the Axis airforce and their estimated rate of consumption.

7. Lubricating Oil Requirements and Wastage and Losses. Lubricating oil requirements were put at five per cent of

the aviation gasoline and motor fuel demand.

It was estimated that wastage and losses including those quantities lost in planes which failed to return absorbed an additional 20 per cent of the above total.

TABLE III

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AXIS AIRFORCE REQUIREMENTS OF PETROLEUM, 1942
(thousand metric tons)

| | WESTERN AND CENTRAL EUROPE | | | EASTERN EUROPE | | | MEDITERRANEAN | | | TOTAL | | | Ground Forces |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Av.Gas. | Mot.Fuel | Lubes | Av.Gas. | Mot.Fuel | Lubes | Av.Gas. | Mot.Fuel | Lubes | Av.Gas. | Mot.Fuel | Lubes | |
| I. Flying | | | | | | | | | | | | | |
| a) G.A.F. | | | | | | | | | | | | | |
| Operational | 79.4 | ---- | 4.8 | 350.9 | ---- | 17.5 | 119.0 | ---- | 6.0 | 549.3 | ---- | 27.5 | 576.8 |
| Transport | 49.4 | ---- | 2.5 | 84.8 | ---- | 4.2 | 35.5 | ---- | 1.8 | 169.7 | ---- | 8.5 | 178.2 |
| Ferrying | 1.2 | ---- | 0.1 | 5.8 | ---- | 0.3 | 2.5 | ---- | 0.1 | 9.5 | ---- | 0.5 | 10.0 |
| Training | 162.3 | ---- | 8.1 | 15.3 | ---- | 0.7 | 6.1 | ---- | 0.3 | 183.7 | ---- | 9.1 | 192.8 |
| Total G.A.F. | 292.3 | ---- | 14.7 | 456.8 | ---- | 22.7 | 163.1 | ---- | 8.2 | 912.2 | ---- | 45.6 | 957.8 |
| b) L.A.F. | | | | | | | | | | | | | |
| Operational | ----- | ---- | ---- | ----- | ---- | ---- | 64.4 | ---- | 3.2 | 64.4 | ---- | 3.2 | 67.6 |
| Transport | ----- | ---- | ---- | ----- | ---- | ---- | 21.8 | ---- | 1.1 | 21.8 | ---- | 1.1 | 22.9 |
| Training | ----- | ---- | ---- | ----- | ---- | ---- | 18.8 | ---- | 0.9 | 18.8 | ---- | 0.9 | 19.7 |
| Total G.A.F. | ----- | ---- | ---- | ----- | ---- | ---- | 105.0 | ---- | 5.2 | 105.0 | ---- | 5.2 | 110.2 |
| c) Axis Satellites | | | | | | | | | | | | | |
| Operational | 8.3 | ---- | 0.4 | 85.3 | ---- | 4.3 | ----- | ---- | --- | 93.6 | ---- | 4.7 | 98.3 |
| Transport | 1.2 | ---- | 0.1 | 12.8 | ---- | 0.6 | ----- | ---- | --- | 14.0 | ---- | 0.7 | 14.7 |
| Training | 1.7 | ---- | 0.1 | 17.1 | ---- | 0.9 | ----- | ---- | --- | 18.8 | ---- | 1.0 | 19.8 |
| Total Satellites | 11.2 | ---- | 0.6 | 115.2 | ---- | 5.8 | ----- | ---- | --- | 126.4 | ---- | 6.4 | 132.8 |
| Total Flying | 303.5 | ---- | 15.3 | 572.0 | ---- | 28.5 | 268.1 | ---- | 13.4 | 1,143.6 | ---- | 57.2 | 1,200.8 |
| II. Supply and Ground Services | | | | | | | | | | | | | |
| G.A.F. | ----- | 160.0 | 8.0 | ----- | 240.0 | 12.0 | ----- | 80.0 | 4.0 | ----- | 480.0 | 24.0 | 504.0 |
| L.A.F. | ----- | ----- | --- | ----- | ----- | --- | ----- | 60.0 | 3.0 | ----- | 60.0 | 3.0 | 63.0 |
| Satellites | ----- | ----- | --- | ----- | 60.0 | 3.0 | ----- | ---- | --- | ----- | 60.0 | 3.0 | 63.0 |
| Total Supply and Ground Services | ----- | 160.0 | 8.0 | ----- | 300.0 | 15.0 | ----- | 140.0 | 7.0 | ----- | 600.0 | 30.0 | 630.0 |
| GRAND TOTAL | 303.5 | 160.0 | 23.3 | 572.0 | 300.0 | 43.5 | 268.1 | 140.0 | 20.4 | 1,143.6 | 600.0 | 87.2 | 1,830.8 |

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## II. PETROLEUM REQUIREMENTS OF THE GERMAN AIRFORCE, 1942

6. Operational Flying. Sortie estimates are available for long range bombers, reconnaissance bombers, dive bombers, single-engine fighters, twin-engine fighters, and army cooperation and coastal planes. Tables four to nine show the most important models of each type of plane, their estimated percentage share in Germany's first line strength, and their normal and maximum fuel tankage.

TABLE IV

TANKAGE CAPACITY OF GERMAN LONG RANGE AND RECONNAISSANCE BOMBERS[1]

| Model | Percent of 1942 first line strength | Tankage (metric tons) Normal | Maximum |
|---|---|---|---|
| Junkers 88 | 56 | 2.157 | 3.336 |
| Heinkel 111 | 30 | 2.561 | 3.181 |
| Dornier 217 | 8 | 2.191 | 4.634 |
| Focke-Wulf 200 | 5 | 1.054 | 3.931 |
| Heinkel 177 | 1 | 6.551 | 11.795 |

TABLE V

TANKAGE CAPACITY OF GERMAN DIVE BOMBERS

| Model | Percent of 1942 first line strength | Tankage (metric tons) Normal | Maximum |
|---|---|---|---|
| Junkers 87 | 100 | 0.354 | 0.802 |

1/ All data (in this and subsequent tables) on tankage capacity taken from "Performance Tables of Foreign Service Aircraft" published by the British Air Ministry.

TABLE VI

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TANKAGE CAPACITY OF GERMAN SINGLE ENGINE FIGHTERS

| Model | Percent of 1942 first line strength | Tankage (metric tons) Normal | Maximum |
|---|---|---|---|
| Messerschmitt 109 | 75 | 0.297 | 0.519 |
| Focke-Wulf 190 | 25 | 0.388 | 0.607 |

TABLE VII

TANKAGE CAPACITY OF GERMAN TWIN ENGINE FIGHTERS

| Model | Percent of 1942 first line strength | Tankage (metric tons) Normal | Maximum |
|---|---|---|---|
| Messerschmitt 110 | 45 | 0.944 | 2.568 |
| Junkers 88 | 40 | 1.247 | 2.662 |
| Dornier 217 | 7 | 2.191 | 4.854 |
| Messerschmitt 210 | 4 | 1.854 | 2.858 |
| Unidentified | 4 | ----- | ----- |

TABLE VIII

TANKAGE CAPACITY OF GERMAN ARMY COOPERATION PLANES

| Model | Percent of 1942 first line strength | Tankage (metric tons) Normal | Maximum |
|---|---|---|---|
| Henschel 126 | 40 | 0.381 | ------ |
| Focke-Wulf 189 | 25 | 0.509 | ------ |
| Messerschmitt 110 | 15 | 0.944 | 2.568 |
| Fieseler 156 | 15 | 0.118 | 0.202 |
| Blohm and Voss 141 | 3 | 0.391 | ----- |
| Unidentified | 2 | ----- | ----- |

TABLE IX

TANKAGE CAPACITY OF GERMAN COASTAL PLANES

| Model | Percent of 1942 first line strength | Tankage (metric tons) Normal | Maximum |
|---|---|---|---|
| Arago 196 | 55 | 0.893 | ----- |
| Blohm and Voss 138 | 15 | 1.685 | 3.876 |
| Heinkel 115 | 15 | 2.056 | 2.494 |
| Unidentified | 15 | ----- | ----- |

On the basis of the formula given under "4" the average gasoline consumption per sortie for each type of plane was calculated and is presented in Table X.

TABLE X

AVERAGE AVIATION GASOLINE CONSUMPTION PER SORTIE

(metric tons)

| | |
|---|---|
| Long range bomber | 1.97 |
| Bomber reconnaissance | 2.45 |
| Dive bombers | 0.35 |
| Single Engine fighter | 0.88 |
| Twin engine fighter | 1.18 |
| Army Cooperation Plane | 0.39 |
| Coastal plane | 0.87 |

The estimated number of sorties in 1942 is given in Table XI.

TABLE XI

GERMAN AIRPLANE SORTIES, 1942

| | Western and Central Europe | Eastern Europe | Medi-terranean | Total |
|---|---|---|---|---|
| Long range bombers 1/ | 10,329 | 78,850 | 25,061 | 114,240 |
| Bomber Reconnaissance 2/ | 4,400 | 17,620 | 6,304 | 28,324 |
| Dive bombers | 1,065 | 55,065 | 10,370 | 66,500 |
| Single engine fighters | 35,960 | 113,800 | 47,005 | 194,565 |
| Twin engine fighters | 15,136 | 20,183 | 9,759 | 45,078 |
| Army cooperation planes | --- | 36,005 | 3,208 | 39,213 |
| Coastal planes | 7,279 | 2,849 | 5,409 | 15,337 |
| TOTAL SORTIES | 72,169 | 323,372 | 107,116 | 503,257 |

1/ Includes reconnaissance sorties for November and December, 1942.
2/ January to October 1942 only.

Total operational consumption of petroleum by the German Air Force, including aviation lubricants (calculated as 5 per cent of aviation gasoline demand) and a 20 per cent allowance for wastage and losses is presented in Table XII.

TABLE XII

OPERATIONAL AVIATION GASOLINE AND LUBRICATING OIL CONSUMPTION OF THE GERMAN AIRFORCE, 1942

(thousand metric tons)

| | Aviation Gasoline | Aviation Lubricants | Total |
|---|---|---|---|
| Long range bombers and bombers reconnaissance | 357.3 | 17.9 | 375.2 |
| Dive bombers | 27.9 | 1.4 | 29.3 |
| Single engine fighters | 65.7 | 3.3 | 69.0 |
| Twin engine fighters | 64.0 | 3.2 | 67.2 |
| Army cooperation planes | 18.4 | 0.9 | 19.3 |
| Coastal planes | 16.0 | 0.8 | 16.8 |
| TOTAL | 549.1 | 27.5 | 576.8 |

9. Air Transport. The models of transport planes used by the German airforce, their estimated percentage share in total transport strength and their tankage are given in Table XIII.

TABLE XIII

TANKAGE CAPACITY OF GERMAN TRANSPORT PLANES

| Model | Percent of 1942 first line strength | Tankage (metric tons) Normal | Maximum |
|---|---|---|---|
| Junkers 52 | 75.0 | 1.803 | ------- |
| Heinkel 111 | 16.6 | 2.861 | 3.181 |
| Focke Wulf 200 | 4.2 | 1.854 | 3.931 |
| Junkers 90 | 2.5 | 2.528 | 5.460 |
| Junkers 86 | 1.7 | 1.121 | ---- |

The average consumption per transport flight,

[redacted] calculated as described under "4" amounts to 1.520 tons per sortie. The number of transport sorties in 1942 was estimated as follows: The rate of loss of transport planes per sortie was assumed to be one in 75, as compared with a ratio of one in 50 for reconnaissance bombers. The estimated number of transport planes lost in 1942 was 1,240. The number of transport sorties would, therefore, amount to 93,000.

The breakdown of sorties by geographical areas was established in accordance with the estimated strength of transport planes in the three main areas. Twenty-nine per cent were stationed in Western and Central Europe, 50 per cent in eastern Europe, and 21 per cent in the Mediterranean.

Lubricating oil requirements were again put at 5 per cent of total fuel demand. An allowance of 20 per cent was made for wastage and losses. Total petroleum consumption for transport planes is presented in Table XIV.

TABLE XIV

AVIATION GASOLINE AND LUBRICATING OIL CONSUMPTION OF GERMAN TRANSPORT PLANES, 1942

(thousand metric tons)

| | Aviation Gasoline | Aviation Lubricants | Total |
|---|---|---|---|
| Western and Central Europe | 48.4 | 2.5 | 51.9 |
| Eastern Europe | 84.8 | 4.2 | 89.0 |
| Mediterranean | 36.5 | 1.8 | 37.3 |
| TOTAL | 169.7 | 8.5 | 178.2 |

10. German Ferrying Activity. Estimates of aviation gasoline consumption in the ferry service from German production centers to the various fronts are based on the number of replacements effected during the year. An estimated total of 11,970 German planes was sent to the various theatres during the year, of which 2,805 went to the Mediterranean area, 3,165 to Western and Central Europe, and 6,000 to the Eastern Front. Thirty per cent of the total number of planes were assumed to be bombers, 50 per cent fighters, and 20 per cent army cooperation planes, dive bombers, etc. The average distance of the German factories from the Mediterranean area was estimated at 900 miles, that from the Eastern Front at 1,000 miles, and that from the Western Europe at 400 miles. The consumption rate of a Junkers 88 was taken as representative for bombers, that of a Messerschmitt 109 (plus a 20 per cent addition to account for twin- engine fighters) for fighters, and that of a Junkers 87 for dive bombers and army cooperation planes. On this basis petroleum consumption per hundred miles was calculated at 0.148 tons for bombers, 0.045 tons for fighters, and 0.070 tons for dive bombers. Total ferrying requirements, including a 5 per cent addition for lubricants and a 20 per cent allowance for wastage and losses, were estimated at 10,000 tons.

Although part of the fuel needed for the ferrying service was obviously tanked at or near the

plane producing centers in Germany, the total quantities needed were allocated to the various fronts in proportion to the above replacement rates.

TABLE XV

AVIATION GASOLINE AND LUBRICATING OIL CONSUMPTION OF THE GERMAN FERRYING SERVICE, 1942

(thousand metric tons)

| | Aviation Gasoline | Aviation Lubricants | Total |
|---|---|---|---|
| Western and Central Europe | 1.2 | 0.1 | 1.3 |
| Eastern Europe | 5.8 | 0.3 | 6.1 |
| Mediterranean | 2.5 | 0.1 | 2.6 |
| TOTAL | 9.5 | 0.5 | 10.0 |

11. Training of the German Airforce. Pilots receive their basic training in A/B schools. The number of airplanes available for basic training was estimated at 2,800. The models used are the Focke-Wulf 44, the Focke-Wulf 58, the Buecker 131, and the Heinkel 72. On the average one and a quarter engines was assumed for each plane with a horsepower per engine of 200. Fuel consumption was estimated at 0.3 lb. of aviation gasoline per horsepower per hour. Assuming that each plane flew 30 hours per month during 1942, aviation gasoline consumption for basic training, including an allowance of 20 per cent for wastage and losses, would amount to 37,000 tons. Lubricating oil requirements, put at 5 per cent of the total fuel demand would amount to an additional 1,800 tons.

The number of planes available in 1942 for advanced operational training was estimated at 1,200, half of which were bombers and half fighters. The average consumption per hour of flying at cruising speed was estimated at 0.4 tons for a bomber and at about one-third to one-quarter this quantity for a fighter.

Assuming 20 hours of flying per bomber per month, petroleum requirements for 600 bombers, including 5 per cent for lubricating oil and a 20 per cent allowance for wastage and losses, would reach 91,000 tons.

The number of flying hours per fighter per month was put at 25 to 30. Petroleum consumption of the 700 fighters including lubricating oil and the 20 per cent allowance for wastage and losses would reach 38,000 tons for 1942.

In addition 600 airplanes were used by Reserve Training Units for operational training at the fronts. As these planes were also used for operational flying, actual requirements of aviation gasoline for training in these planes was put at 50 per cent of the above consumption rate for training in bombers and fighters. Total petroleum consumption of Reserve Training Units would thus amount to 86,000 tons.

Total training requirements for the German airforce are shown in Table XVI.

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TABLE XVI

AVIATION GASOLINE AND LUBRICATING OIL REQUIREMENTS

OF GAF TRAINING UNITS, 1942

(thousand metric tons)

| | Aviation Gasoline | Aviation Lubricants | Total |
|---|---|---|---|
| Basic Training | 36.6 | 1.6 | 38.6 |
| Operational Training | | | |
| Bombers | 86.4 | 4.3 | 90.7 |
| Fighters | 36.0 | 1.8 | 37.8 |
| Total Operational | 122.4 | 6.1 | 128.5 |
| Reserve Training Units | 24.5 | 1.2 | 25.7 |
| GRAND TOTAL | 183.7 | 9.1 | 192.8 |

It was assumed that petroleum requirements for basic and operational training were supplied in Germany. The consumption of Reserve Training Units was actually allocated to the three main areas of operation in proportion to operational aviation gasoline requirements.

## III. PETROLEUM REQUIREMENTS OF THE ITALIAN AIRFORCE

12. Operational Flying. The total number of sorties of the Italian airforce in 1942 was estimated at 100,000. With a first-line strength of 1,500 planes, the average number of sorties per plane comes to 66 per year, or about 50 per cent of the corresponding German figure. An estimated 20 per cent of the total number of sorties were fighter sorties and 80 per cent bomber sorties. The average petroleum consumption per sortie was again calculated as described under "4". Normal and maximum tankage capacity of Italian fighter and bomber models and their percentage share in the enemy's first line strength are shown in Table 17.

TABLE XVII

TANKAGE CAPACITY OF ITALIAN AIRPLANES

| Model: | Per cent of 1942 first line strength | Tankage (metric tons) Normal | Maximum |
|---|---|---|---|
| BOMBERS | | | |
| Savoia-Marchetti S.M. 79 and 84 | 51 | 2,022 | 3.774 |
| Cantieri Riuniti Cant.Z1007 | 29 | 1.955 | 3.134 |
| Fiat BR 20 | 20 | 1.786 | 2.689 |
| **Fighters** | | | |
| Macchi M.C. 202 | 45 | 0.297 | ----- |
| Caproni-Reggiane Re 2001 | 16 | 0.489 | ----- |
| Fiat C.R. 42 | 16 | 0.259 | ----- |
| Fiat G.50 | 16 | 0.192 | 0.233 |
| Caproni-Reggiane 2000 | 7 | 0.268 | 1,072 |

Average aviation gasoline consumption per bomber sortie was accordingly calculated at 1.733 tons and that per fighter sortie 0.238 tons. Operational aviation gasoline and lubricating oil consumption, including a 20 per cent allowance for wastage and losses, is shown in Table 18.

TABLE XVIII

AVIATION GASOLINE AND LUBRICATING OIL CONSUMPTION OF THE ITALIAN AIRFORCE, 1942
(thousand metric tons)

| | Aviation Gasoline | Aviation Lubricants | Total |
|---|---|---|---|
| Operational | | | |
| Bombers | 41.6 | 2.1 | 43.7 |
| Fighters | 22.8 | 1.1 | 23.9 |
| Total Operational | 64.4 | 3.2 | 67.6 |
| Air Transportation | 21.8 | 1.1 | 22.9 |
| Training | 18.8 | 0.9 | 19.7 |
| TOTAL | 105.0 | 5.2 | 110.2 |

13. Italian Air Transport. Two hundred and twenty-five air transport planes were believed available in 1942. The sortie rate per plane was estimated as a little over 50 per cent of the corresponding rate for German transport planes. Italian transport sorties were therefore computed as 8,000.

The model commonly used for air transportation is the Savoia 82, with a normal tankage capacity of 2.595 tons and a maximum tankage capacity of 4.381 tons. The average gasoline consumption per sortie, calculated according to the formula given under "4", amounts to 2.281 tons. Aviation

gasoline and lubricating oil requirements, including an allowance of 20 per cent for wastage and losses, are shown in Table 18.

14. Training of the Italian Air Force. The number of airplanes available for training purposes in 1942 was estimated at 900 to 950. An estimated 600 of these planes were trainers and 300 to 350 operational planes. Aviation gasoline consumption for training purposes was again estimated on the basis of the assumption that the sortie rate of Italian training planes is about half that of German trainers, while their consumption per sortie is the same.

The consumption of aviation gasoline and lubricating oil for training purposes, including a 20 per cent allowance for wastage and losses, is shown in Table 18.

## IV. PETROLEUM REQUIREMENTS OF THE AIRFORCES OF AXIS SATELLITE COUNTRIES.

15. Estimates of Petroleum Consumption. The estimated average air strength of Axis satellite countries in 1942 is shown in Table 19.

TABLE XIX

AIR STRENGTH OF AXIS SATELLITE COUNTRIES, 1942

| | Bombers | Fighters | Reconnaissance Army Coop. Planes, etc. | Total Number of Planes |
|---|---|---|---|---|
| Hungary | 66 | 100 | 240 | 306 |
| Rumania | 115 | 188 | 82 | 385 |
| Bulgaria | 98 | 146 | 106 | 350 |
| Finland | 100 | 185 | 45 | 330 |
| Croatia | 30 | 80 | 40 | 150 |
| Metropolitan France | 110 | 200 | 40 | 350 |

As already explained under "5", the number of annual sorties per bomber and per fighter was put at about 50 per cent of the German rate and that of reconnaissance and army cooperation planes at 80 per cent. The average consumption per sortie was assumed to be about 70 per cent of that of corresponding German planes. The petroleum consumption for training and transport planes was estimated at 20 per cent and 15 per cent of the operational requirements, respectively. Aviation gasoline and lubricating oil consumption including a 20 per cent allowance for wastage and losses, for the various Axis satellite countries is shown in Table 20.

TABLE XX

AVIATION GASOLINE AND LUBRICATING OIL

CONSUMPTION OF THE AIRFORCE OF

AXIS SATELLITE COUNTRIES, 1942
(thousand metric tons)

| | Aviation Gasoline | Lubricants | Total |
|---|---|---|---|
| Hungary | 35.5 | 1.8 | 37.3 |
| Rumanian | 27.0 | 1.4 | 28.4 |
| Bulgaria | 26.3 | 1.3 | 27.6 |
| Finland | 21.4 | 1.1 | 22.5 |
| Croatia | 5.0 | 0.2 | 5.2 |
| France | 11.2 | 0.6 | 11.8 |
| TOTAL | 126.4 | 6.4 | 132.8 |

## IV. PETROLEUM REQUIREMENTS FOR SUPPLY AND GROUND SERVICES

16. The German Airforce. Motor transportation for servicing airplanes and airfields is allocated to the various "Gruppen" comprising 3 "Staffeln"(usually a group of 9 airplanes), and to the Operational Airforce Command, (OAFC). The OAFC is in charge of the various air fields under the Airdrome Regional Command (ARC). The number of motor vehicles per Gruppe vary for Gruppen of long range bombers, single-engine fighters, twin-fighters and other planes.

Supply services are organized for the most part under the Luftgau, and the Airdrome Regional Command. Supplies are carried in transport Kolonnen and fuel Kolonnen, ordinarily comprising 12 trucks. The total motor fleet of the G.A.F. as presented in Table 21, was estimated largely on the basis of a British study of "The Organization of the German Airforce."

The total number of motor vehicles attached to the German Airforce can thus be estimated at 61,000 units. Including trucks for the supply of anti-aircraft establishments and self-propelled guns used by the air force, the total number of motor vehicles under the control of the German Airforce may well amount to 75,000. If a daily petroleum consumption of 5-6 U.S. gallons per vehicle per

MOTOR FLEET OF THE GERMAN AIR FORCE

I. Motor Fleet Attached to the "Gruppen"

| | Number of "Gruppen" 1/ | Average Motor Transport per "Gruppe" | TOTAL Motor Transport |
|---|---|---|---|
| Long Range Bombers | 60 | 50 | 3,000 |
| Single Engine Fighters | 60 | 120 | 7,200 |
| Twin Engine Fighters and Dive Bombers | 30 | 150 | 4,500 |
| Others | 5 | 30 | 150 |
| | | | 14,850 |

II. Motor Fleet Attached to the "Operational Airfield Command" (O.A.C.)

| Number of O.A.C. 2/ | Average Motor Transport per O.A.C. | TOTAL Motor Transport |
|---|---|---|
| 450 | 75 | 33,750 |

III. Motor Fleet Attached to the "Luftgau" and "Airfield Regional Command" (A.R.C.)

| | Number in O.A.F. | Average Number of "Transport and Fuel Kolonnen" | Average Number of motor vehicles per "Kolonne" | Total Motors Transport |
|---|---|---|---|---|
| Luftgau | 18 | 25 | 12 | 5,400 |
| A.R.C. | 90 | 6-7 | 12 | 7,020 |
| Total | | | | 12,420 |
| GRAND TOTAL (I II III) | | | | 61,420 |

1/ On a full strength basis

2/ Five O.A.C. assumed to be available per A.R.C. and 5 A.R.C. per Luftgau. The number of O.A.C.'s of 450 corresponds actually to the estimated number of airfields in use.

day is assumed, (allowing an average of 50-60 miles daily per vehicle) total motor fuel consumption amounts to 420,000 tons a year. A 15 per cent addition for wastage and losses, raises motor fuel requirements of the German Airforce to 480,000 tons. Lubricating oil consumption has again been put at 5 per cent of the motor fuel demand or at 24,000 tons.

In accordance with the geographical breakdown of aviation gasoline consumption, half of the total ground and supply service requirements or 252,000 tons were more or less arbitrarily allocated to Eastern Europe, one-third or 168,000 tons to Western and Central Europe, and one-sixth or 84,000 tons to the Mediterranean area.

17. The Airforces of Italy and of Axis Satellite Countries. The requirements of the Italian Airforce, of Axis Satellites, and of their ground and supply services were estimated at one-eighth of the German requirements, or at 63,000 tons each. This rate corresponds to the relationship between the aviation gasoline consumption of Germany, Italy, and Axis Satellite countries, respectively. Such consumption would be more than sufficient to support some 10,000 motor vehicles for the Italian airforce and the same number for that of Axis satellite countries.

Total Axis consumption of petroleum for ground and supply services was thus estimated at 600,000 tons of motor fuel and 30,000 tons of lubricants. One-quarter of the total motor fuel consumption, or 150,000 tons probably consists of Diesel oil, and 450,000 tons of light motor fuel.